US009091980B2

(12) **United States Patent**
Egi

(10) **Patent No.: US 9,091,980 B2**
(45) **Date of Patent: Jul. 28, 2015**

(54) **FIXING DEVICE AND IMAGE FORMING APPARATUS**

(71) Applicant: **KYOCERA Document Solutions Inc.**, Osaka (JP)

(72) Inventor: **Makoto Egi**, Osaka (JP)

(73) Assignee: **KYOCERA Document Solutions Inc.**, Osaka (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/305,440**

(22) Filed: **Jun. 16, 2014**

(65) **Prior Publication Data**

US 2014/0376979 A1 Dec. 25, 2014

(30) **Foreign Application Priority Data**

Jun. 20, 2013 (JP) 2013-129456

(51) **Int. Cl.**
G03G 15/20 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 15/2053*** (2013.01); *G03G 2215/2035* (2013.01)

(58) **Field of Classification Search**
USPC 399/107, 110, 122, 320, 328, 329
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,014,539 A 1/2000 Sano et al.
2011/0135355 A1 * 6/2011 Baba 399/329

FOREIGN PATENT DOCUMENTS

JP H10-48977 A 2/1998

* cited by examiner

Primary Examiner — Hoan Tran
(74) *Attorney, Agent, or Firm* — Studebaker & Brackett PC

(57) **ABSTRACT**

A fixing device includes a fixing belt, a pressuring rotation body, a cap member and an elastic member. The cap member includes a main body part covering an outside of an end part of the fixing belt and a flange part covering an external diameter side of the end part. The elastic member includes a belt insertion part into which the end part is inserted, a cap insertion part into which the flange part is inserted and a contact part coming into contact with an internal side face of the main body part. When the fixing belt is deformed to an internal diameter side, the elastic member is elastically deformed to make the belt insertion part moved to the internal diameter side, and then, a gap is formed in at least a part between the internal side face of the main body part and the contact part.

18 Claims, 11 Drawing Sheets

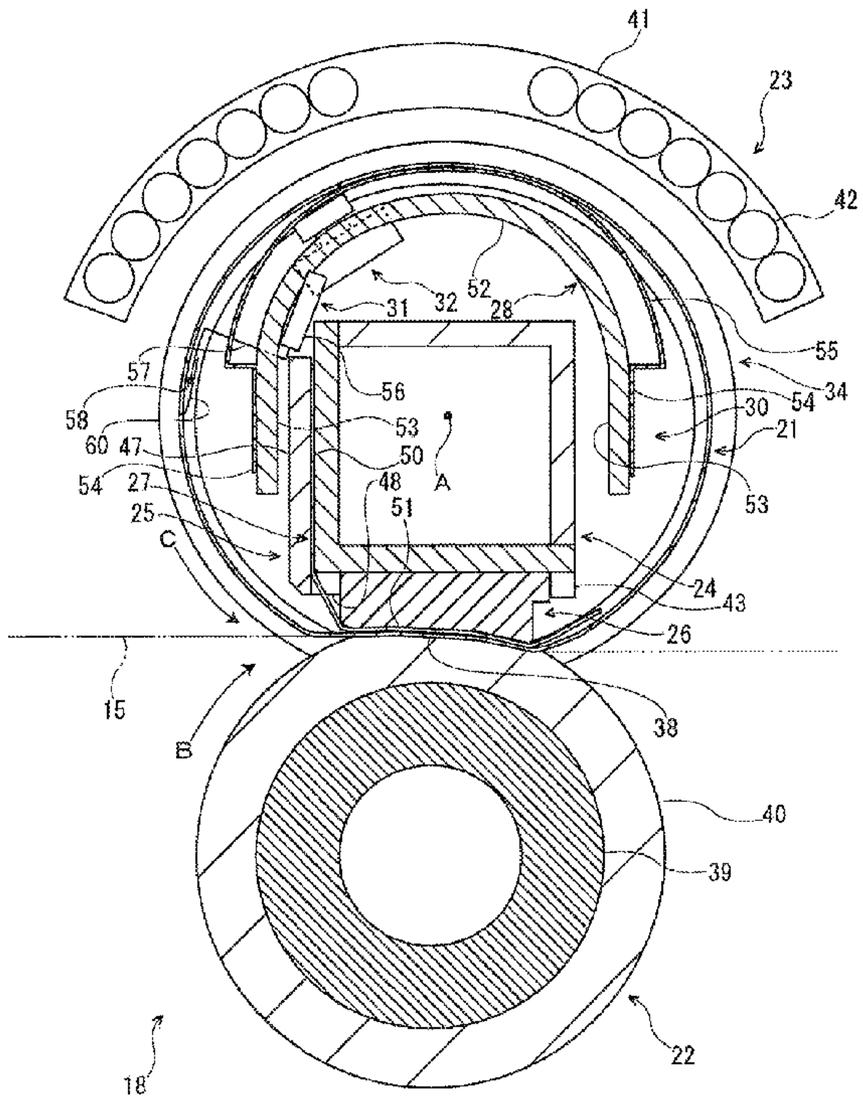


FIG. 1

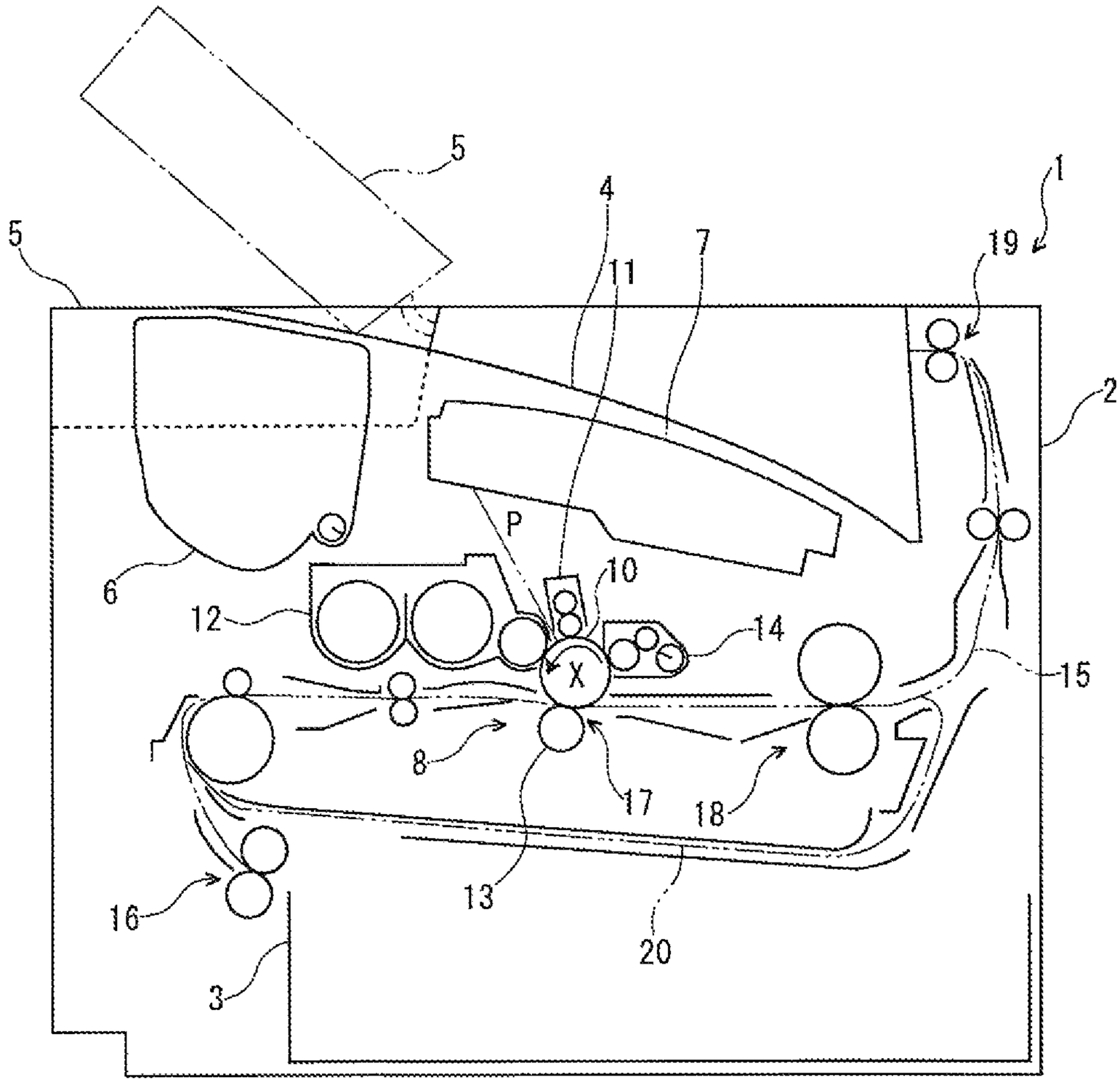


FIG. 2

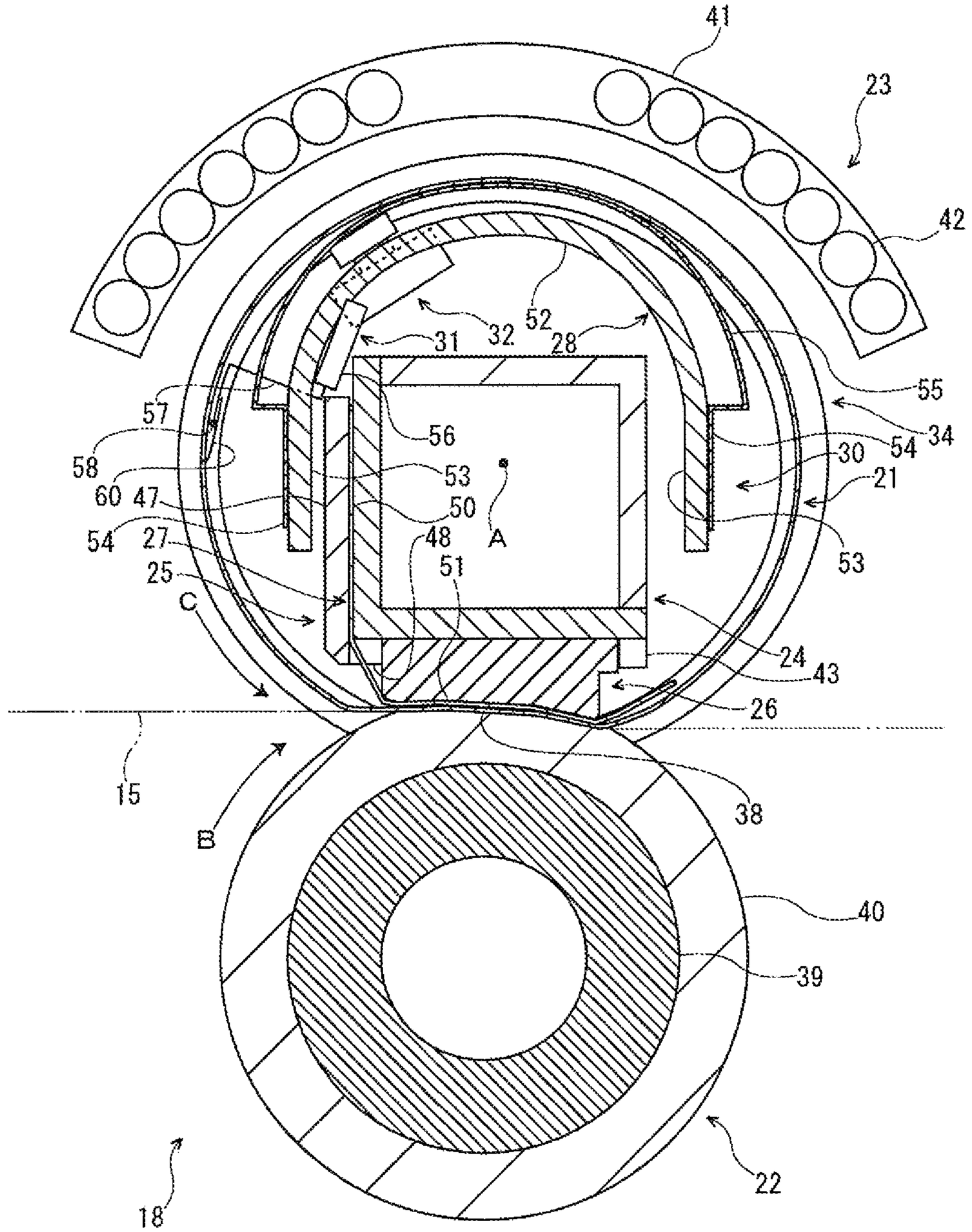

41
23
42
31
32
52
28
55
57
56
34
54
58
30
60
47
53
21
50
54
27
48
A
53
25
51
C
24
43
26
15
38
B
40
39
18
22

FIG. 3

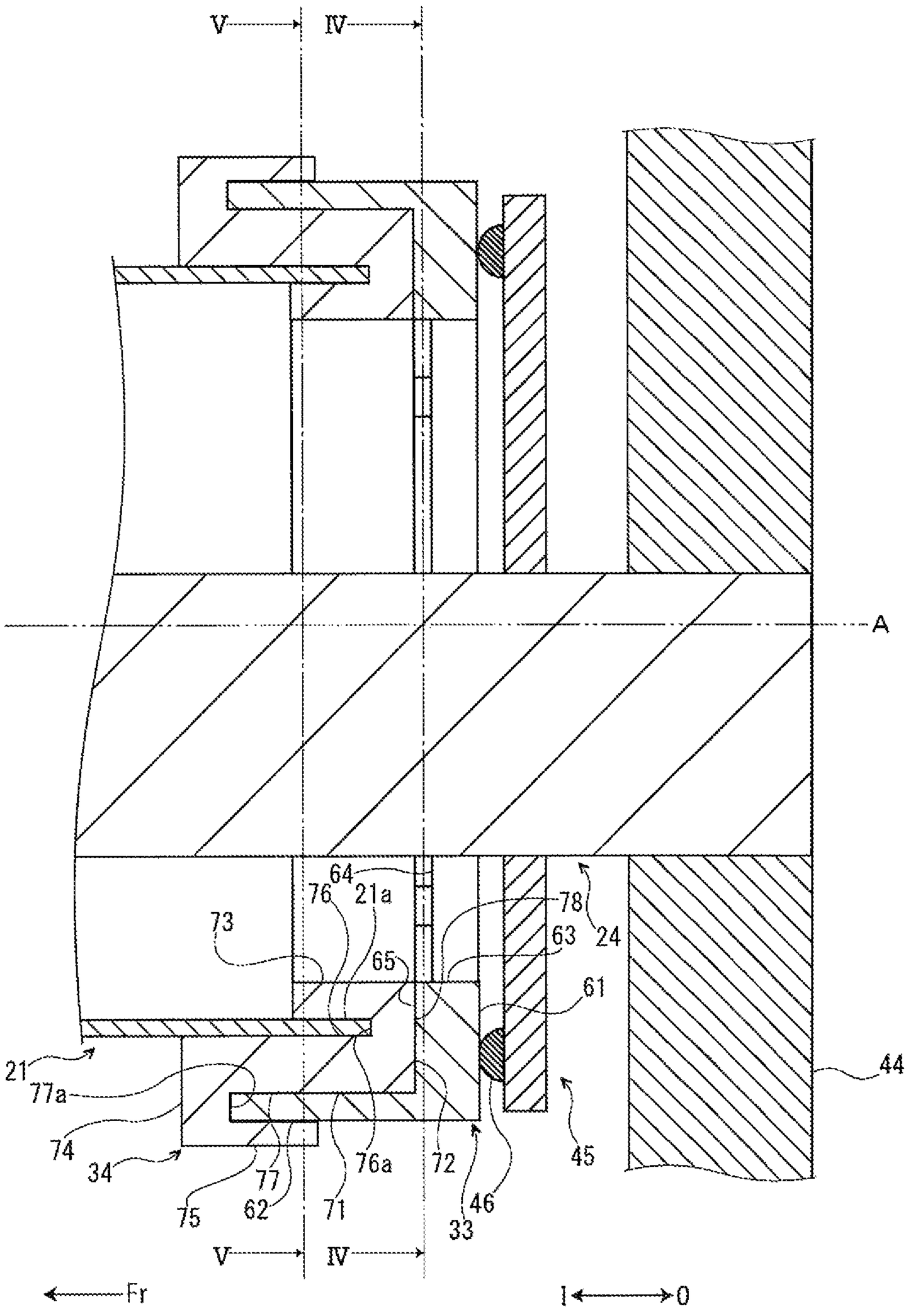

V
IV
A
64
76
21a
78
24
73
63
65
61
44
21
77a
74
34
76a
72
45
77
75
62
71
46
33
V
IV
Fr
I
O

FIG. 4

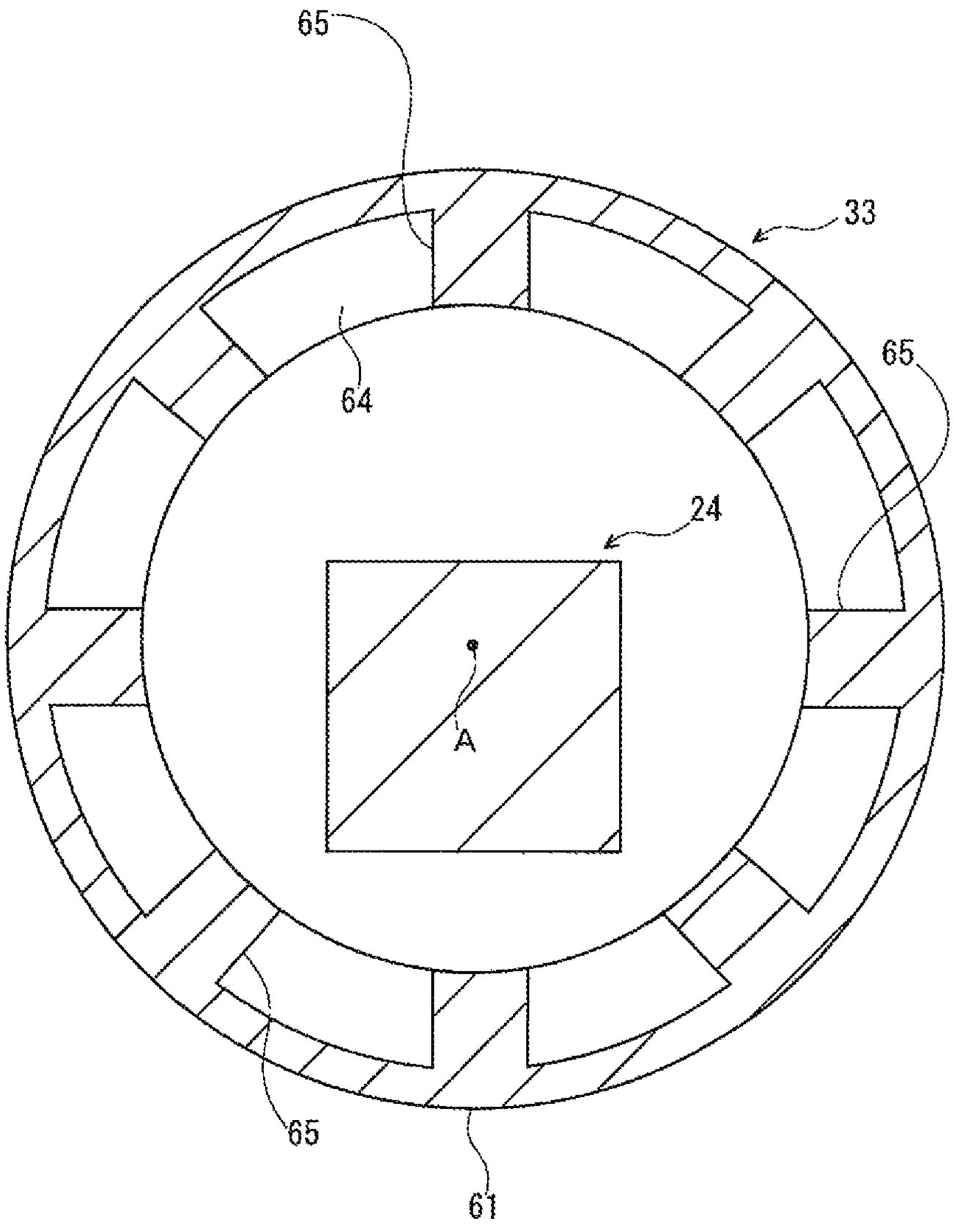


FIG. 5

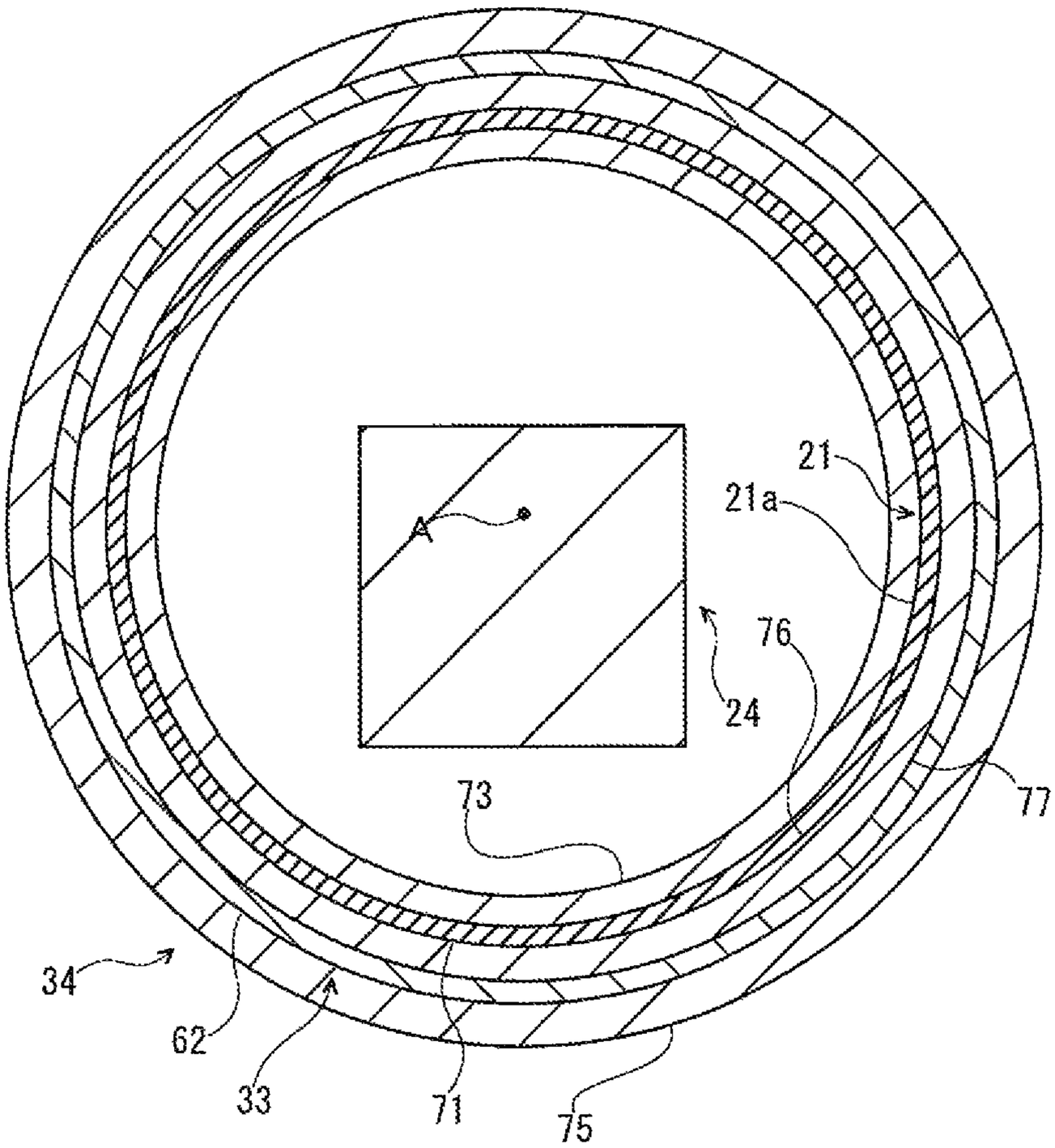


FIG. 6

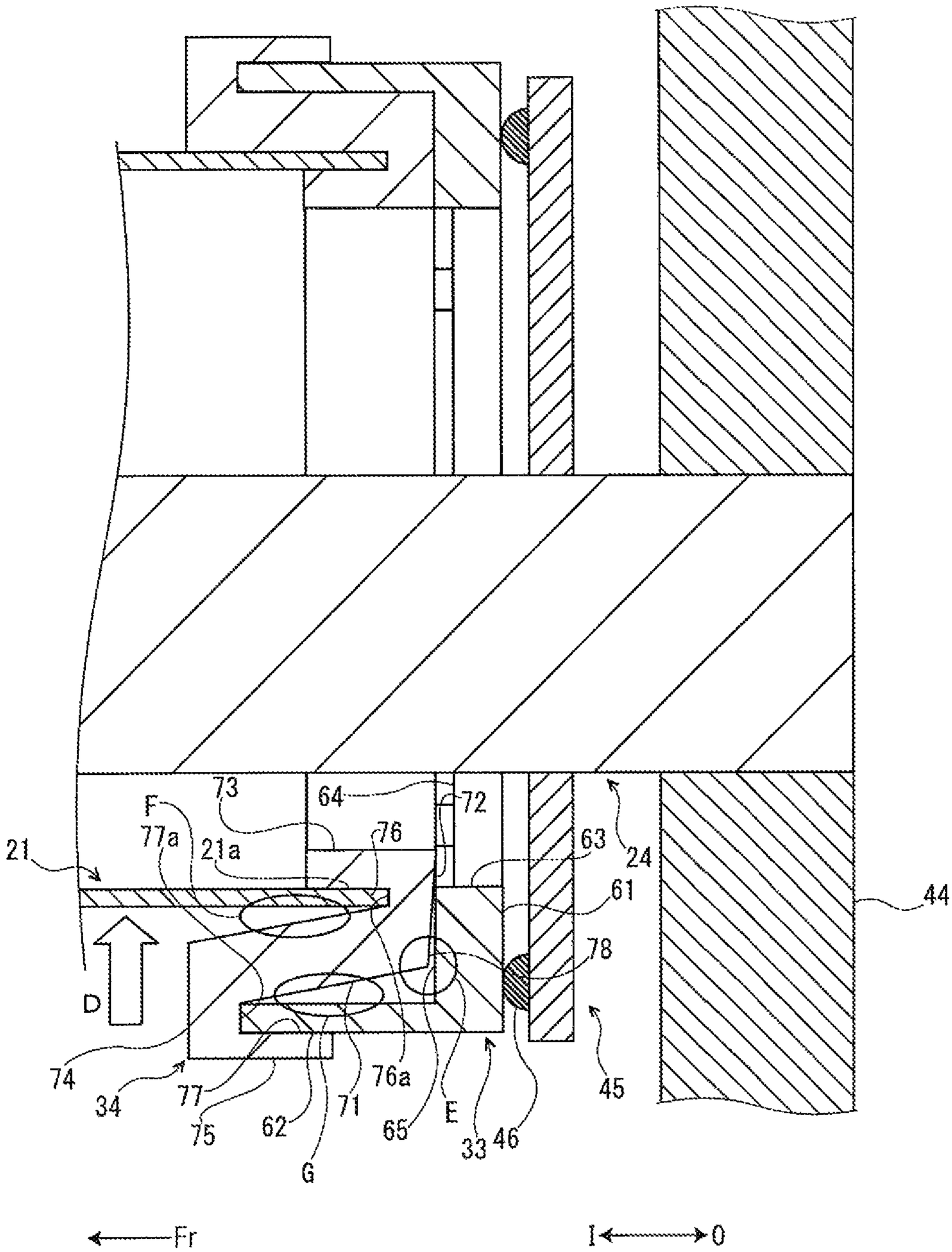

73
64
72
F
77a
21a
76
63
24
21
61
44
78
D
74
34
77
75
62
71
76a
65
E
33
46
45
G
Fr
I
O

FIG. 7

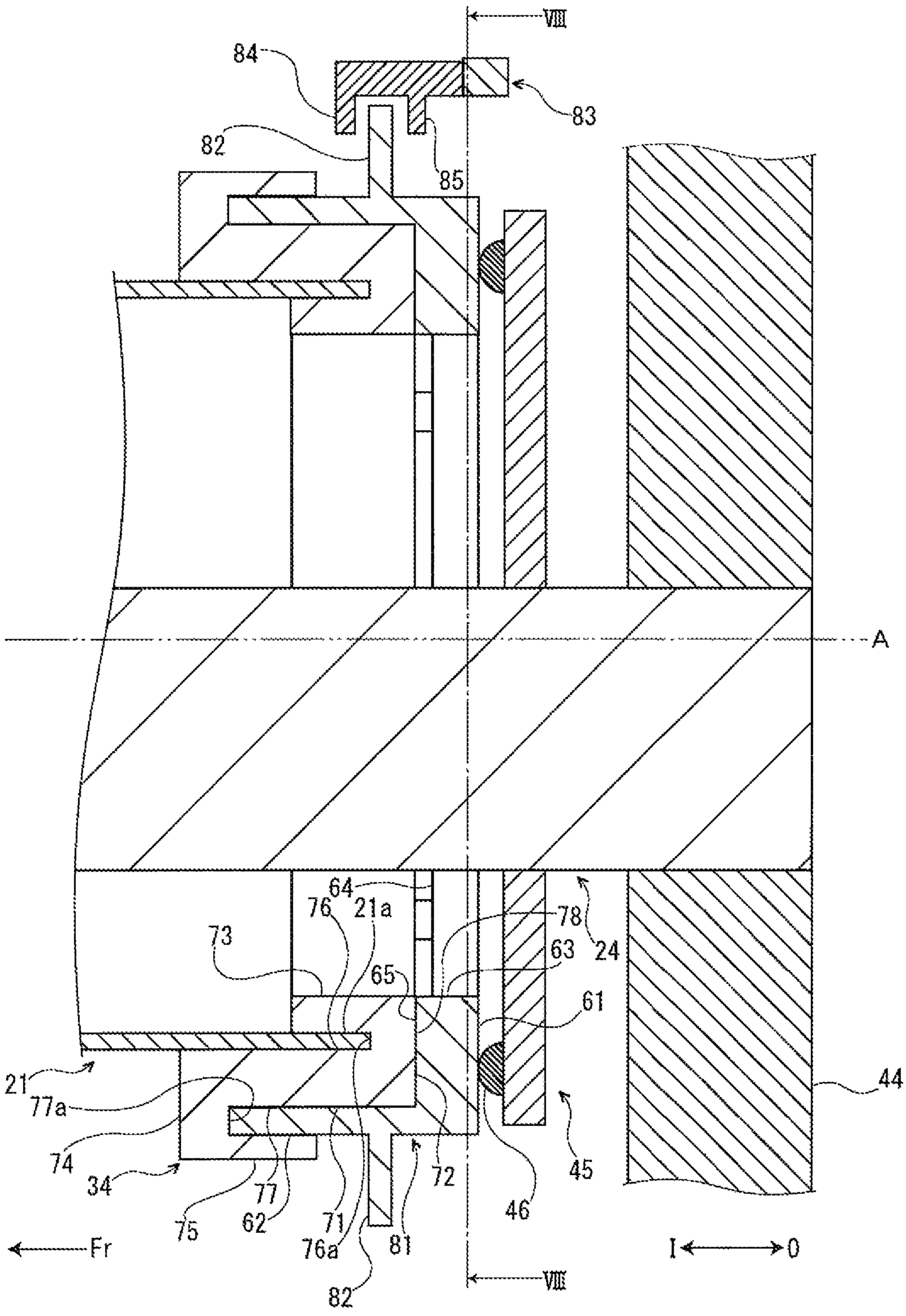

VIII
84
83
82
85
A
64
76
21a
78
24
73
63
65
61
44
21
77a
74
34
77
72
45
75
62
71
46
Fr
76a
81
I
O
82
VIII

FIG. 8

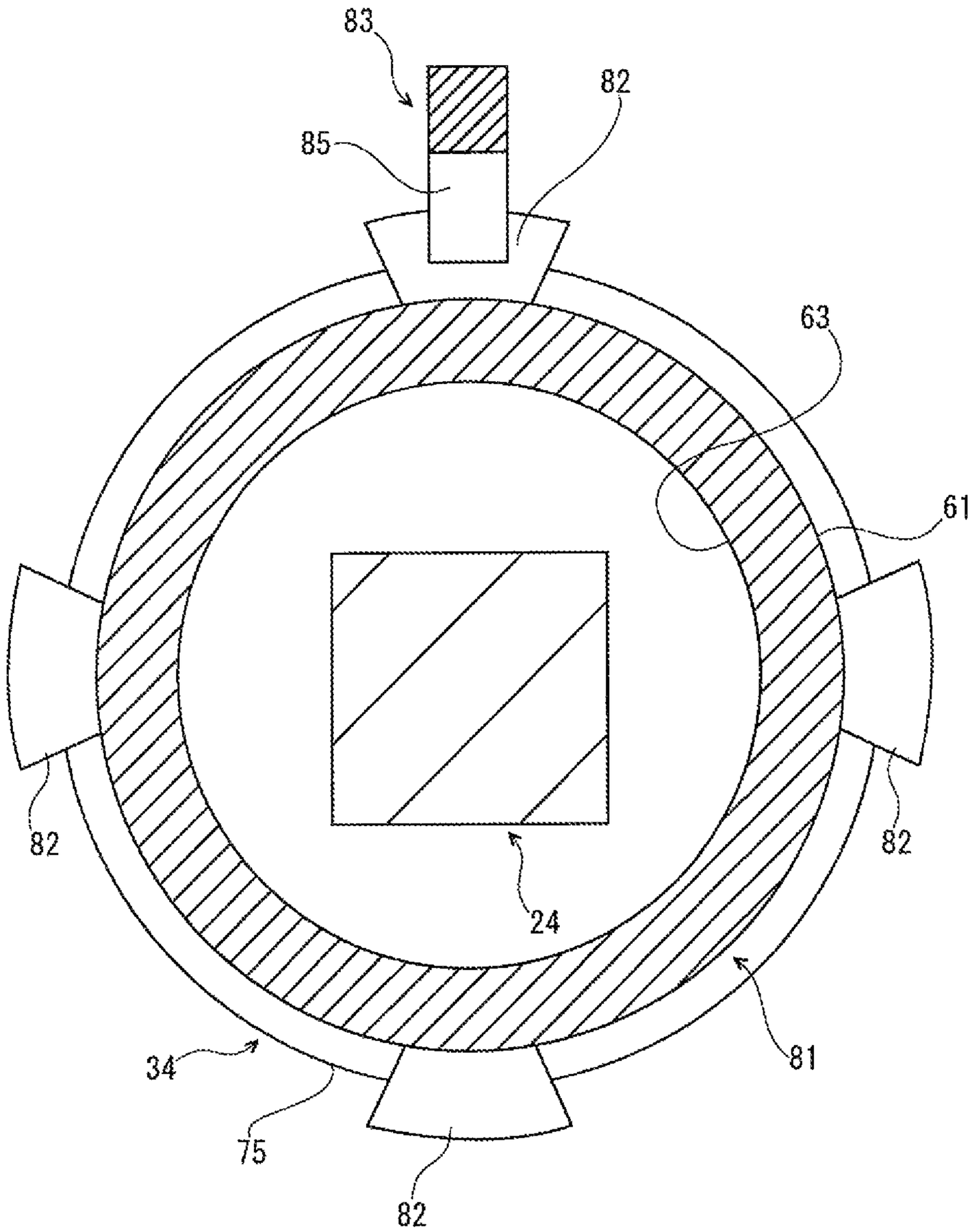


FIG. 9

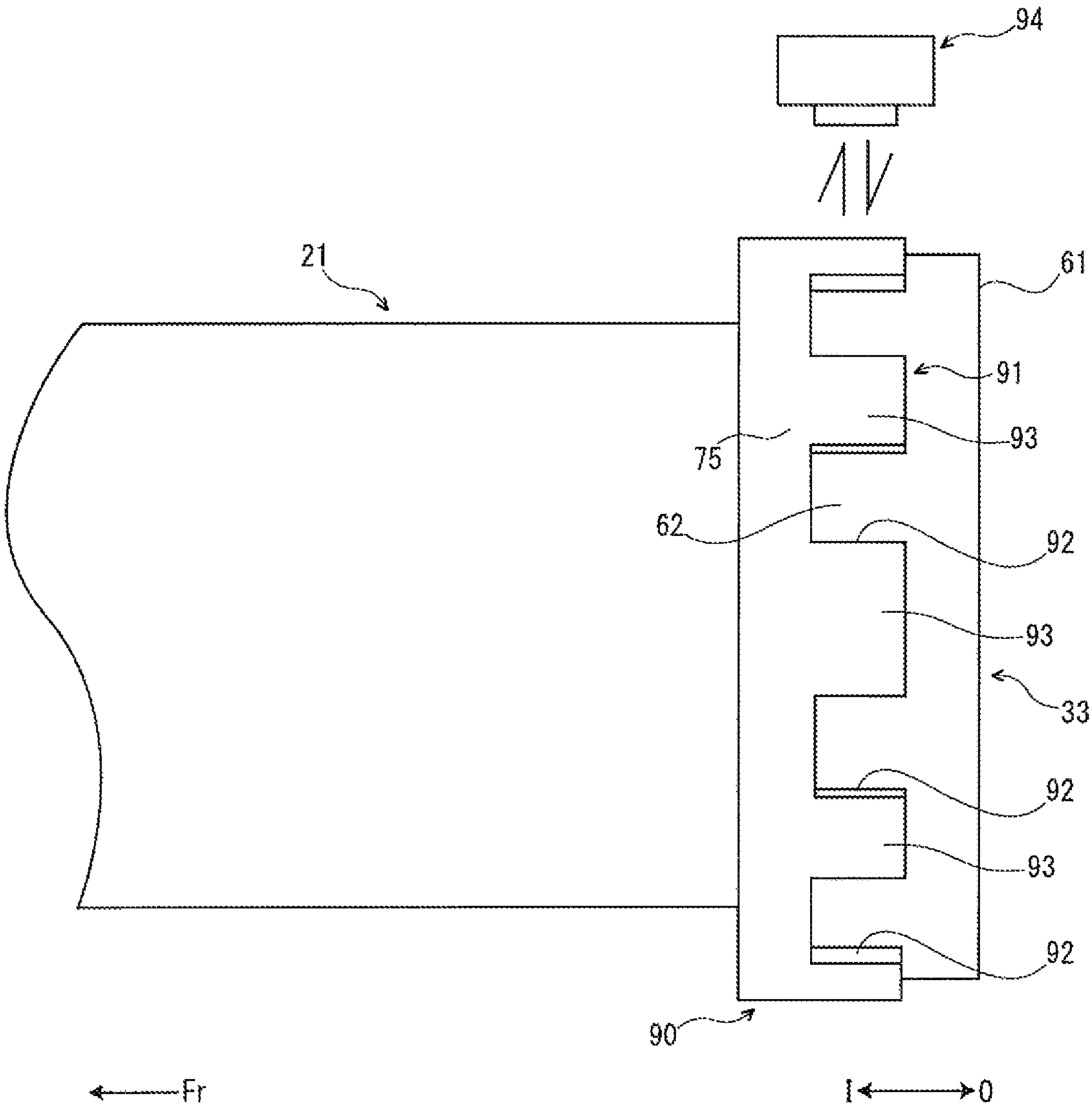


FIG. 10

Related Art

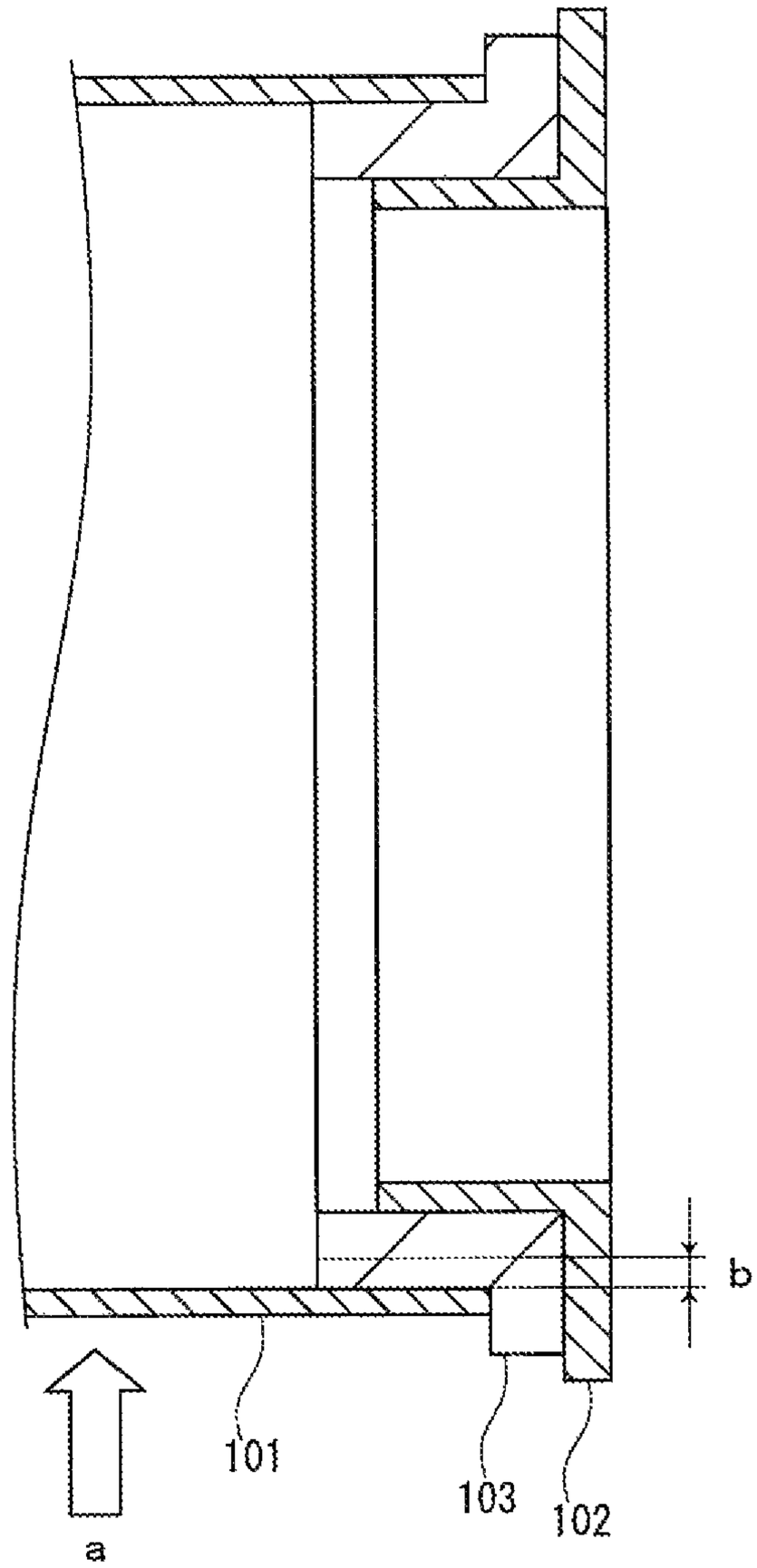
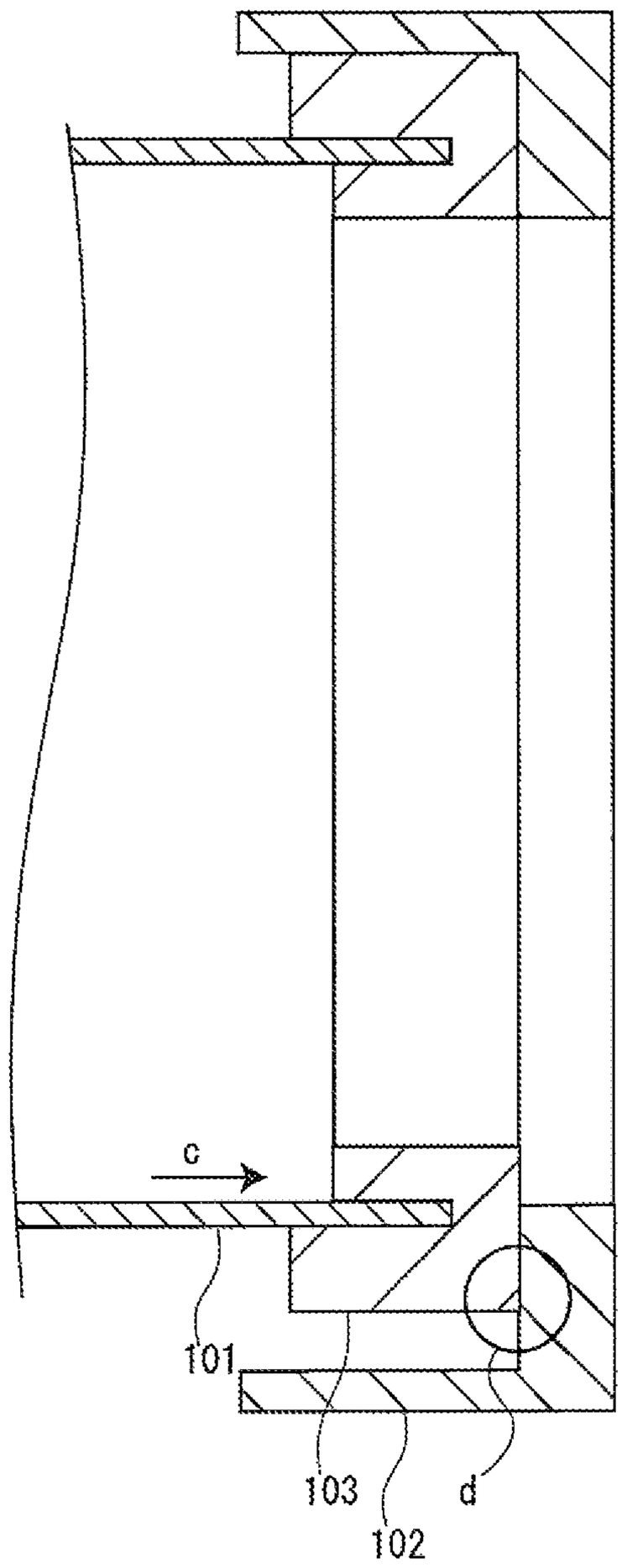


FIG. 11

Related Art



FIXING DEVICE AND IMAGE FORMING APPARATUS

INCORPORATION BY REFERENCE

This application is based on and claims the benefit of priority from Japanese Patent application No. 2013-129456 filed on Jun. 20, 2013, the entire contents of which are incorporated herein by reference.

BACKGROUND

The present disclosure relates to a fixing device fixing a toner image on a recording medium and an image forming apparatus including the fixing device.

An electrographic image forming apparatus, such as a printer or a copying machine, forms a toner image on a surface of a recording medium, such as a sheet, and then, heats and pressures the recording medium and toner image by a fixing device, thereby fixing the toner image on the recording medium.

As a manner applied in the above-mentioned fixing device, a manner forming a fixing nip heating and pressuring the recording medium and toner image by a fixing roller and a pressuring roller is known. The above-mentioned fixing roller is formed, for example, by covering the outer circumference face of a cored bar made of metal by a resin having high toner releasability. As a heat source heating the above-mentioned fixing roller, for example, a halogen heater is used. The halogen heater is arranged, for example, inside the cored bar of the fixing roller.

On the other hand, another manner (so-called as an "IH (Induction Heating) manner") using an IH coil as the heat source instead of the halogen heater is known. The above-mentioned IH coil produces magnetic field by conducting electricity. In such an IH manner-type fixing device, instead of forming the fixing nip by the fixing roller and pressuring roller, the fixing nip is often formed by a fixing belt and the pressuring roller. The above-mentioned fixing belt is made of a rotatable endless belt. The magnetic field produced by the above-mentioned IH coil acts on the fixing belt so as to produce eddy current, thereby generating heat in the fixing belt.

As a rotating manner of the fixing belt, a manner rotating the fixing belt together with one or more rollers arranged at an internal diameter side of the fixing belt is known. On the other hand, another manner sliding the fixing belt with respect to a pressuring member arranged at the internal diameter side of the fixing belt is also known.

In the fixing device with such a manner, the fixing belt may be biased to one side in a rotation axis direction due to a gap of alignment of components of the fixing device, variation of temperature in the fixing device or other cause. Restriction of such a bias of the fixing belt is one of important tasks.

As a configuration achieving such an task, there is a configuration suppressing the bias of the fixing belt by holding an end part of the fixing belt by a resin member (e.g., a resin cap or a resin ring) and restricting movement of the above-mentioned resin member in the rotation axis direction of the fixing belt. However, if such a configuration is applied, there are possibilities that, since the end part of the fixing belt and resin member are rubbed, a crack in the end part of the fixing belt is caused and the resin member is scraped.

By contrast, there is a fixing device including a cap member attached to the end part of the fixing belt and an elastic member interposed between the fixing belt and cap member.

A first problem of the fixing device having such a configuration will be explained with reference to FIG. **10**. In a configuration as shown in FIG. **10**, a part of the cap member **102** is inserted into an internal diameter side of the fixing belt **101**, and then, the elastic member **103** is interposed between the fixing belt **101** and cap member **102**. In such a configuration, if deformation of the fixing belt **101** to the internal diameter side is attempted according to pressure (refer to an arrow a in FIG. **10**) from the pressuring roller, the fixing belt **101** is not deformed more than a pressure deformation amount (refer to an arrow b in FIG. **10**) of the elastic member **103**. Therefore, it is difficult to respond to a case where great deformation of the fixing belt **101** to the internal diameter side is desired, i.e., a case where widening of width of the fixing nip is desired.

Next, a second problem of the fixing device having the above-mentioned configuration will be explained with reference to FIG. **11**. In the configuration shown in FIG. **11**, an external diameter side of the fixing belt **101** is covered by a part of the cap member **102** and the elastic member **103** is interposed between the fixing belt **101** and cap member **102**. If such a configuration is applied, since the deformation of the fixing belt **101** to the internal diameter side is not restricted, the pressure deformation amount of the fixing belt **101** may be sufficiently secured.

However, biased force (refer to an arrow c in FIG. **11**) to one side in the rotation axis direction is added to the fixing belt **101**, and then, the elastic member **103** is pressured to the cap member **102** by this force. Therefore, when the fixing belt **101** after passing through the fixing nip is restored to the external diameter side, a catch occurs in a contact part (refer to an area surrounded by a circle d in FIG. **11**) of the cap member **102** and elastic member **103** and the restoration of the fixing belt **101** to the external diameter side is obstructed.

SUMMARY

In accordance with an embodiment of the present disclosure, a fixing device includes a fixing belt, a pressuring rotation body, a cap member and an elastic member. The fixing belt rotates around a rotation axis. The pressuring rotation body comes into pressure contact with the fixing belt to form a fixing nip. The cap member is attached to an end part of the fixing belt. The cap member includes a main body part and a flange part. The main body part covers the outside in the rotation axis direction of the end part of the fixing belt. The flange part is extended from the main body part to the inside in the rotation axis direction and covers an external diameter side of the end part of the fixing belt. The elastic member is interposed between the end part of the fixing belt and the cap member. The elastic member includes a belt insertion part, a cap insertion part and a contact part. Into the belt insertion part, the end part of the fixing belt is inserted. The cap insertion part is arranged at the external diameter side from the belt insertion part. Into the cap insertion part, the flange part is inserted. The contact part is arranged at the outside in the rotation axis direction from the belt insertion part and cap insertion part. The contact part comes into contact with an internal side face in the rotation axis direction of the main body part. When the fixing belt is deformed to an internal diameter side, the elastic member is elastically deformed so as to make the belt insertion part moved to the internal diameter side with respect to the cap insertion part, and then, a gap is formed in at least a part between the internal side face in the rotation axis direction of the main body part and the contact part.

In accordance with an embodiment of the present disclosure, an image forming apparatus includes a fixing device.

The fixing device includes a fixing belt, a pressuring rotation body, a cap member and an elastic member. The fixing belt rotates around a rotation axis. The pressuring rotation body comes into pressure contact with the fixing belt to form a fixing nip. The cap member is attached to an end part of the fixing belt. The cap member includes a main body part and a flange part. The main body part covers the outside in the rotation axis direction of the end part of the fixing belt. The flange part is extended from the main body part to the inside in the rotation axis direction and covers an external diameter side of the end part of the fixing belt. The elastic member is interposed between the end part of the fixing belt and the cap member. The elastic member includes a belt insertion part, a cap insertion part and a contact part. Into the belt insertion part, the end part of the fixing belt is inserted. The cap insertion part is arranged at the external diameter side from the belt insertion part. Into the cap insertion part, the flange part is inserted. The contact part is arranged at the outside in the rotation axis direction from the belt insertion part and cap insertion part. The contact part comes into contact with an internal side face in the rotation axis direction of the main body part. When the fixing belt is deformed to an internal diameter side, the elastic member is elastically deformed so as to make the belt insertion part moved to the internal diameter side with respect to the cap insertion part, and then, a gap is formed in at least apart between the internal side face in the rotation axis direction of the main body part and the contact part.

The above and other objects, features, and advantages of the present disclosure will become more apparent from the following description when taken in conjunction with the accompanying drawings in which a preferred embodiment of the present disclosure is shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram schematically showing a printer according to a first embodiment of the present disclosure.

FIG. **2** is a sectional view showing a fixing device of the printer according to the first embodiment of the present disclosure.

FIG. **3** is a side sectional view showing a rear end part of a fixing belt and the periphery in the fixing device of the printer according to the first embodiment of the present disclosure.

FIG. **4** is a sectional view taken along a line IV-IV of FIG. **3**.

FIG. **5** is a sectional view taken along a line V-V of FIG. **3**.

FIG. **6** is a side sectional view showing the fixing device in a situation in which the fixing belt is deformed to an internal diameter side of the printer according to the first embodiment of the present disclosure.

FIG. **7** is a side sectional view showing the rear end part of the fixing belt and the periphery in the fixing device of the printer according to a second embodiment of the present disclosure.

FIG. **8** is a sectional view taken along a line VIII-VIII of FIG. **7**.

FIG. **9** is a side view showing the rear end part of the fixing belt and the periphery in the fixing device of the printer according to a third embodiment of the present disclosure.

FIG. **10** is a side sectional view showing a configuration of a fixing device.

FIG. **11** is a side sectional view showing a configuration of another fixing device.

DETAILED DESCRIPTION

First Embodiment

First, with reference to FIG. **1**, the entire structure of a printer **1** (an image forming apparatus) will be described.

The printer **1** includes a box-like formed printer main body **2**. In a lower part of the printer main body **2**, a sheet feeding cartridge **3** storing sheets (recording mediums) is installed and, in a top face of the printer main body **2**, a sheet ejected tray **4** is formed. To top face of the printer main body **2**, an upper cover **5** is openably/closably attached at the side of the sheet ejected tray **4** and, below the upper cover **5**, a toner container **6** is installed.

In an upper part of the printer main body **2**, an exposure device **7** composed of a laser scanning unit (LSU) is located below the sheet ejected tray **4**. Below the exposure device **7**, an image forming part **8** is arranged. In the image forming part **8**, a photosensitive drum **10** as an image carrier is rotatably arranged. Around the photosensitive drum **10**, a charger **11**, a development device **12**, a transfer roller **13** and a cleaning device **14** are located along a rotating direction (refer to an arrow X in FIG. **1**) of the photosensitive drum **10**.

Inside the printer main body **2**, a conveying path **15** for the sheet is arranged. At an upstream end in the conveying path **15**, a sheet feeder **16** is positioned. At an intermediate stream part in the conveying path **15**, a transferring part **17** composed of the photosensitive drum **10** and transfer roller **13** is positioned. At a downstream part in the conveying path **15**, a fixing device **18** is positioned. At a downstream end in the conveying path **15**, a sheet ejecting part **19** is positioned. Below the conveying path **15**, an inversion path **20** for duplex printing is arranged.

Next, the operation of forming an image by the printer **1** having such a configuration will be described.

When the power is supplied to the printer **1**, various parameters are initialized and initial determination, such as temperature determination of the fixing device **18**, is carried out. Subsequently, in the printer **1**, when image data is inputted and a printing start is directed from a computer or the like connected with the printer **1**, image forming operation is carried out as follows.

First, the surface of the photosensitive drum **10** is electric-charged by the charger **11**. Then, exposure corresponding to the image data on the photosensitive drum **10** is carried out by a laser light (refer to a two-dot chain line P in FIG. **1**) from the exposure device **7**, thereby forming an electrostatic latent image on the surface of the photosensitive drum **10**. Subsequently, the development device **12** develops the electrostatic latent image by a toner (a developer).

On the other hand, a sheet fed from the sheet feeding cartridge **3** by the sheet feeder **16** is conveyed to the transferring part **17** in a suitable timing for the above-mentioned image forming operation, and then, the toner image carried on the photosensitive drum **10** is transferred onto the sheet in the transferring part **17**. The sheet with the transferred toner image is conveyed to a downstream side in the conveying path **15** to go forward to the fixing device **18**, and then, the toner image is fixed on the sheet in the fixing device **18**. The sheet with the fixed toner image is ejected from the sheet ejecting part **19** to the sheet ejected tray **4**. The toner remained on the photosensitive drum **10** is collected by the cleaning device **14**.

Next, the fixing device **18** will be described in detail with reference to FIGS. **2-5**.

Hereinafter, it will be described so that the front side of the fixing device **18** is positioned at the near side of FIG. **2**, for convenience of explanation. An arrow Fr in FIG. **3** indicates the front side of fixing device **18**. An arrow I in FIG. **3** indicates the inside in forward and backward directions and an arrow O in FIG. **3** indicates the outside in the forward and backward directions.

As shown in FIGS. **2** and **3**, the fixing device **18** includes a fixing belt **21**, a pressuring roller **22** (a pressuring rotation body), an IH (Induction Heating) fixing unit **23**, a supporting member **24**, a reinforcement member **25**, a pressing pad **26** (a pressing member), a slide contacting member **27**, a magnetism shielding member **28**, a guide member **30**, thermistors **31** (a temperature detecting part), a thermal insulating part **32** (a so-called thermo-cut), cap members **33** and elastic members **34**. The pressuring roller **22** is positioned below the fixing belt **21**. The IH fixing unit **23** is positioned above the fixing belt **21**. The supporting member **24** is positioned at an internal diameter side of the fixing belt **21**. The reinforcement member **25** is positioned at the internal diameter side of the fixing belt **21** and at the left side of the supporting member **24**. The pressing pad **26** is positioned at the internal diameter side of the fixing belt **21** and at the downward side of the supporting member **24**. The slide contacting member **27** is positioned at the internal diameter side of the fixing belt **21** and from the left side to the downward side in the supporting member **24** and pressing pad **26**. The magnetism shielding member **28** is positioned at the internal diameter side of the fixing belt **21** and at the upward side of the supporting member **24**. The guide member **30** is positioned at the internal diameter side of the fixing belt **21** and at the upward side of the magnetism shielding member **28**. The thermistors **31** are positioned at the internal diameter side of the fixing belt **21** and at the left side of the supporting member **24**. The thermal insulating part **32** is positioned at the internal diameter side of the fixing belt **21** and at the left upward side of the supporting member **24**. The cap members **33** are attached to end parts **21***a* of the fixing belt **21**. Each elastic member **34** is interposed between the end part **21***a* of the fixing belt **21** and cap member **33**. In the embodiment, the end parts **21***a* of the fixing belt **21** are both end parts in the forward and backward directions of the fixing belt **21**.

The fixing belt **21** is an endless thin belt having flexibility and is formed in a cylindrical shape elongated in the forward and backward directions. The fixing belt **21** is arranged to rotate around a rotation axis A extended in the forward and backward directions. That is, in the embodiment, a rotation axis direction of the fixing belt **21** is equal to the forward and backward directions.

The fixing belt **21** is composed of, for example, a base material layer and a release layer covering the base material layer. The base material layer of the fixing belt **21** is made of, for example, metal, such as nickel or stainless, or resin, such as polyimide (PI). The release layer of the fixing belt **21** is made of, for example, fluorine-based resin, such as perfluoro alkoxy alkane (PFA). The fixing belt **21** may have an elastic layer between the base material layer and release layer. The elastic layer is made of, for example, a silicone rubber.

The pressuring roller **22** is formed in a cylindrical shape elongated in the forward and backward directions. As shown in FIG. **2**, the pressuring roller **22** comes into pressure contact with the fixing belt **21** and a fixing nip **38** is formed between the fixing belt **21** and pressuring roller **22**. When the sheet is passed through the fixing nip **38**, the sheet and toner image is heated and pressured, and then, the toner image is fixed to the sheet.

The pressuring roller **22** is rotatably supported by a fixing frame (not shown). The pressuring roller **22** is connected with a drive source (not shown), such as a drive motor. The pressuring roller **22** is composed of, for example, a cylindrical cored bar **39**, an elastic layer **40** provided around the cored bar **39** and a release layer (not shown) covering the elastic layer **40**. The cored bar **39** of the pressuring roller **22** is made of, for example, metal, such as stainless or aluminum. The elastic layer **40** of the pressuring roller **22** is made of, for example, a silicone rubber or a silicone sponge. The release layer of the pressuring roller **22** is made of, for example, fluorine-based resin, such as PFA.

As shown in FIG. **2**, the IH fixing unit **23** includes a case member **41** and an IH coil **42** (a heat source) installed in the case member **41**. The IH coil **42** is positioned at the external diameter side of the fixing belt **21** and arranged in an arc-like form along the outer circumference of the fixing belt **21**.

The supporting member **24** is extended in the forward and backward directions to penetrate the fixing belt **21**. The supporting member **24** is made, for example, by combining a pair of L-shaped metal plates and has a rectangular sectional shape. In a right lower corner part of the supporting member **24**, a supporting protrusion **43** is provided to protrude to the downward side.

As shown in FIG. **3**, both end parts in the forward and backward directions of the supporting member **24** are fixed to fixing members **44** respectively arranged at the front side and rear side of the fixing belt **21**. The fixing members **44** are, for example, fixed to a fixing frame (not shown) or constitute a part of the fixing frame.

To both end parts in the forward and backward directions of the supporting member **24**, ring-like formed bias stopping members **45** are fixed. The bias stopping members **45** are positioned at the internal side in the forward and backward directions from the respective fixing members **44**. In faces at the internal side in the forward and backward directions of the bias stopping members **45**, annular protruding parts **46** are respectively arranged.

As shown in FIG. **2**, the reinforcement member **25** has a roughly L-shaped section and includes a first reinforcement part **47** extending in upward and downward directions and a second reinforcement part **48** bent from the lower end of the first reinforcement part **47** to the right side.

The pressing pad **26** is extended in the forward and backward directions. Atop face of the pressing pad **26** is fixed to a bottom face of the supporting member **24**. Thereby, the pressing pad **26** is supported by the supporting member **24**. A bottom face of the pressing pad **26** presses the fixing belt **21** from the internal diameter side to the downward side (to the side of the pressuring roller **22**). The pressing pad **26** is inserted between the supporting protrusion **43** of the supporting member **24** and the second reinforcement part **48** of the reinforcement member **25**.

The slide contacting member **27** has, for example, a sheet-like shape. The slide contacting member **27** includes a first contact part **50** extending in the upward and downward directions and a second contact part **51** bent from the lower end of the first contact part **50** to the right side. The first contact part **50** is inserted between a left side part of the supporting member **24** and the first reinforcement part **47** of the reinforcement member **25**. The second contact part **51** is inserted between the bottom face of the pressing pad **26** and the fixing belt **21**. When the fixing belt **21** is rotated, the fixing belt **21** slides with respect to the pressing pad **26** and second contact part **51**. The fixing device **18** of the embodiment is configured to apply a so-called "slide belt manner".

The magnetism shielding member **28** includes a curved plate part **52** curved in an arc-like form to the upward side and flat plate parts **53** extending from the both end parts in left and

right directions of the curved plate part **52** to the downward side. The magnetism shielding member **28** is made of, for example, nonmagnetic material with excellent electric conductivity, such as oxygen free copper. The magnetism shielding member **28** prevent a magnetic field produced by the IH coil **42** from passing through the supporting member **24**.

The guide member **30** is arranged so as to cover the upper side of the magnetism shielding member **28**. The guide member **30** is made of, for example, a magnetic body. The guide member **30** has a function generating heat by the action of the magnetic field produced by the IH coil **42** to heat the fixing belt **21**. The guide member **30** includes attachment parts **54** attached to the flat plate parts **53** of the magnetism shielding member **28** and a connection part **55** curved in an arc-like form to the upward side and connecting the attachment parts **54**. The connection part **55** guides (strains) the fixing belt **21** from the internal diameter side.

A plurality of the thermistors **31** are arranged at intervals in the forward and backward directions. The thermistors **31** are respectively arranged at a sheet passing region (a region where a maximum size of the sheet is passed) and a non-sheet passing region (a region where a maximum size of the sheet is not passed) in the fixing belt **21**. Each thermistor **31** includes a housing **56** fixed to the curved plate part **52** of the magnetism shielding member **28**, a plate spring **57** having an end part attached to the housing **56** and a terminal **58** fixed to another end of the plate spring **57**. The terminal **58** is pressured to an inner circumference face of the fixing belt **21** by given pressure of the plate spring **57**. That is, in the thermistor **31** of the embodiment, a contact manner is applied. The terminal **58** is covered by a cover sheet **60**.

The thermal insulating part **32** is fixed to the curved plate part **52** of the magnetism shielding member **28**. The thermal insulating part **32** faces to the sheet passing region of the fixing belt **21** at an interval. The thermal insulating part **32** has a function stopping the production of the magnetic field from the IH coil **42** to prevent excessive temperature rise of the fixing belt **21** when the temperature of the sheet passing region of the fixing belt **21** becomes a predetermined value or more.

The cap member **33** is made of, for example, heat resistant resin, such as liquid crystal polymer or polyphenylene sulfide (PPS). As shown in FIG. **3**, the cap member **33** includes a main body part **61** covering the outside in the forward and backward directions of the end part **21***a* of the fixing belt **21** and a cylindrical flange part **62** extending from an end part at the external diameter side of the main body part **61** to the inside in the forward and backward directions and covering the external diameter side of the end part **21***a* of the fixing belt **21**.

The main body part **61** of the cap member **33** is arranged roughly perpendicular to the rotation axis A of the fixing belt **21**. In the main body part **61**, a circular communication hole **63** is arranged in the forward and backward directions, and then, the supporting member **24** penetrates the communication hole **63**. With an external side face in the forward and backward directions of the main body part **61**, the protruding part **46** of the bias stopping member **45** comes into contact. Thereby, movement of the cap member **33** to the outside in the forward and backward directions is restricted. As shown in FIG. **4**, in a face **64** (hereinafter, called as an "inside face **64**") at the inside in the forward and backward directions of the main body part **61**, a plurality of ribs **65** (e.g., eight ribs **65** in the embodiment) are projected. The plurality of the ribs **65** are arranged radially around the rotation axis A of the fixing belt **21**.

As shown in FIG. **3**, the flange part **62** of the cap member **33** is arranged in roughly parallel to the rotation axis A of the fixing belt **21**. The flange part **62** is arranged at an interval from an outer circumference face of the fixing belt **21**.

The elastic member **34** is made of, for example, a heat resistant rubber, such as a silicone rubber. The elastic member **34** includes a cylindrical first wall part **71**, a second wall part **72**, a third wall part **73**, a fourth wall part **74** and a fifth wall part **75**. The first wall part **71** is extending in the forward and backward directions. The second wall part **72** is bent from an end part at the outside in the forward and backward directions of the first wall part **71** to the internal diameter side. The third wall part **73** is bent from an end part at the internal diameter side of the second wall part **72** to the inside in the forward and backward directions. The fourth wall part **74** is bent from an end part at the inside in the forward and backward directions of the first wall part **71** to the external diameter side. The fifth wall part **75** is bent from an end part at the external diameter side of the fourth wall part **74** to the outside in the forward and backward directions. The first wall part **71** is inserted between the end part **21***a* of the fixing belt **21** and flange part **62** of the cap member **33**.

In the elastic member **34**, an annular belt insertion part **76** is formed so as to be surrounded by the first wall part **71**, second wall part **72** and third wall part **73**. The belt insertion part **76** is formed in a concave shape and opened to the inside in the forward and backward directions. Into the belt insertion part **76**, the end part **21***a* of the fixing belt **21** is inserted. The belt insertion part **76** and end part **21***a* of the fixing belt **21** are not glued to each other.

In the elastic member **34**, an annular cap insertion part **77** is formed so as to be surrounded by the first wall part **71**, fourth wall part **74** and fifth wall part **75**. The cap insertion part **77** is formed in a concave shape and opened to the outside in the forward and backward directions. Into the cap insertion part **77**, the flange part **62** of the cap member **33** is inserted. The cap insertion part **77** and flange part **62** are not glued to each other. An end part **77***a* at the inside in the forward and backward directions of the cap insertion part **77** is arranged at the inside in the forward and backward directions from an end part **76***a* at the outside in the forward and backward directions of the belt insertion part **76**. The cap insertion part **77** is arranged at the external diameter side from the belt insertion part **76** (refer to FIG. **5**).

As shown in FIG. **3**, in the elastic member **34**, a contact part **78** is arranged on the outside face in the forward and backward directions of the second wall part **72**. The contact part **78** is arranged at the outside in the forward and backward directions from the belt insertion part **76** and cap insertion part **77**. The contact part **78** comes into contact with the plurality of the ribs **65** arranged in the inside face **64** of the main body part **61** of the cap member **33**.

In the above-mentioned configuration, when the toner image is formed on the sheet, the drive source (not shown) works to rotate the pressuring roller **22** (refer to an arrow B in FIG. **2**). When the pressuring roller **22** is thus rotated, the fixing belt **21** coming into pressure contact with the pressuring roller **22** is co-rotated in an opposite direction to the pressuring roller **22** (refer to an arrow C in FIG. **2**). When the fixing belt **21** is thus rotated, each cap member **33** and each elastic member **34** are co-rotated by friction force between the end part **21***a* of the fixing belt **21** and each elastic member **34** and friction force between each elastic member **34** and each cap member **33**. On the other hand, when the fixing belt **21** is rotated, the supporting member **24**, pressing pad **26** and slide contacting member **27** are kept in stopping states.

In addition, when the toner image is formed on the sheet, high frequency current is flowed in the IH coil **42**. According to this, the IH coil **42** produces the magnetic field, the action of the magnetic field produces eddy current to the fixing belt **21**, and then, the heat is generated to the fixing belt **21**. In such a situation, when the sheet is passed through the fixing nip **38**, the sheet and toner image is heated and pressured, and then, the toner image is fixed on the sheet.

When the toner image is fixed on the sheet as mentioned above, when the fixing belt **21** is passed through the fixing nip **38**, as indicated by avoid arrow D in FIG. **6**, the pressuring roller **22** (not shown in FIG. **6**) pressures the fixing belt **21** to the upper side. By this pressuring, when the fixing belt **21** is deformed to the internal diameter side, the elastic member **34** is elastically deformed so as to make the belt insertion part **76** moved to the internal diameter side with respect to the cap insertion part **77**. According to this, the first wall part **71** of the elastic member **34** is inclined with respect to the forward and backward directions and the contact part **78** of the elastic member **34** is inclined with respect to the ribs **65** of the main body part **61** of the cap member **33**, and then, a gap is formed between an external diameter side part of the contact part **78** and external diameter side parts of the ribs **65** (refer to an area surrounded by a circle E in FIG. **6**).

Therefore, when the fixing belt **21** passed through the fixing nip **38** is restored to the external diameter side, a catch between the ribs **65** and the contact part **78** hardly occurs, and then, it is possible to smoothly restore the fixing belt **21** to the external diameter side. Moreover, since the gap is formed between the external diameter side part of the contact part **78** and the external diameter side parts of the ribs **65**, it is possible to reduce friction between the contact part **78** and ribs **65**. According to this, it is possible to suppress abrasion of the cap member **33** and elastic member **34**.

When the fixing belt **21** is deformed to the internal diameter side as mentioned above, a gap is formed in a part between the belt insertion part **76** of the elastic member **34** and the end part **21***a* of the fixing belt **21** (refer to an area surrounded by a circle F in FIG. **6**) and a gap is formed in a part between the cap insertion part **77** of the elastic member **34** and the flange part **62** of the cap member **33** (refer to an area surrounded by a circle G in FIG. **6**). Therefore, it is possible to improve restoration force restoring the fixing belt **21** passed through the fixing nip **38** to the external diameter side.

As mentioned above, since the elastic member **34** is elastically deformed so as to make the belt insertion part **76** moved to the internal diameter side with respect to the cap insertion part **77**, elastic force restoring the belt insertion part **76** to the external diameter side is caused in the elastic member **34**. According to this, the fixing belt **21** passed through the fixing nip **38** is more easily restored to the external diameter side.

In the embodiment, the flange part **62** of the cap member **33** is arranged so as to cover the external diameter side of the end part **21***a* of the fixing belt **21**. Therefore, the deformation of the fixing belt **21** to the internal diameter side is not restricted by the presence of the flange part **62**, and then, it is possible to sufficiently secure a deformation amount of the fixing belt **21** to the internal diameter side. According to this, it is possible to respond to a case where great deformation of the fixing belt **21** to the internal diameter side is desired, i.e., a case where widening of width of the fixing nip **38** is desired.

The belt insertion part **76** is formed so as to be surrounded by the first wall part **71**, second wall part **72** and third wall part **73**. In addition, the cap insertion part **77** is formed so as to be surrounded by the first wall part **71**, fourth wall part **74** and fifth wall part **75**. Moreover, the contact part **78** is formed in the outside face in the forward and backward directions of the second wall part **72**. By applying such a configuration, it is possible to form the belt insertion part **76**, cap insertion part **77** and the contact part **78** in simple structures.

In the inside face **64** of the main body part **61**, the radial ribs **65** are arranged. Therefore, it is possible to reduce contact area of the inside face **64** of the main body part **61** to the contact part **78**. Thereby, it is possible to improve slidability of the inside face **64** of the main body part **61** to the contact part **78**, and then, to effectively prevent occurrence of the catch between the inside face **64** of the main body part **61** and the contact part **78**.

The fixing device **18** is configured to apply the so-called "slide belt manner" and to include the pressing pad **26** pressing the fixing belt **21** to the downward side (to the side of the pressuring roller **22**) and the supporting member **24** supporting the pressing pad **26**. Therefore, it is possible to reduce heat capacity of the fixing device **18** and to swiftly rise temperature of the fixing belt **21**.

In the embodiment, the radial ribs **65** are arranged in the inside face **64** of the main body part **61**, thereby improving the slidability of the inside face **64** of the main body part **61** to the contact part **78**. However, in another embodiment, a ring-like cover sheet may be inserted between the inside face **64** of the main body part **61** and the contact part **78** in order to improve the slidability of the inside face **64** of the main body part **61** to the contact part **78**.

In the embodiment, a case of applying the configuration of the present disclosure to the fixing device **18** having the so-called "slide belt manner" was described. However, in another embodiment, the configuration of the present disclosure may be applied to the fixing device having another manner rotating the fixing belt **21** together with one or more rollers arranged at the internal diameter side of the fixing belt **21**.

In the embodiment, a case of inputting drive from the drive source (not shown) to the pressuring roller **22** was described. However, in another embodiment, the drive from the drive source may be inputted to the fixing belt **21** or the drive from the drive source may be inputted to both the pressuring roller **22** and fixing belt **21**.

In the embodiment, a case of using the IH coil **42** as the heat source was described. However, in another embodiment, another heater, such as a halogen heater or a ceramic heater, may be used as the heat source.

The embodiment was described in a case of applying the configuration of the present disclosure to the printer **1**. On the other hand, in another embodiment, the configuration of the disclosure may be applied to another image forming apparatus, such as a copying machine, a facsimile or a multifunction peripheral.

Second Embodiment

Next, the second embodiment of the present disclosure will be described with reference to FIGS. **7** and **8**. An arrow Fr in FIG. **7** indicates the front side of fixing device **18**. An arrow I in FIG. **7** indicates the inside in forward and backward directions and an arrow O in FIG. **7** indicates the outside in the forward and backward directions. Since other components except for a cap member **81** are configured in a similar way to the first embodiment, same reference numerals as the first embodiment are attached to the other components (particularly, in the figures) and the description of the other components is omitted. With regard to similar parts of the cap member **81** to the cap member **33** in the first embodiment, same

reference numerals as the cap member **33** are attached (particularly, in the figures) and the description is omitted.

In the outer circumference part of the flange part **62** of the cap member **81**, detected parts **82** are protruded. The outer circumference part of the flange part **62** corresponds to the outer circumference part of the entire cap member **81**. As shown in FIG. **8**, each detected part **82** is formed in a roughly fan-like shape. A plurality of the detected parts **82** (four detected parts **82** in the embodiment) are arranged at equal angular intervals (at intervals of 90 degrees in the embodiment).

As shown in FIG. **7**, above the flange part **62** of the cap member **81**, a sensor **83** (a detecting part) is arranged. The sensor **83** is, for example, a photo interrupter (PI) sensor and includes a light emitting part **84** emitting light to the detected part **82** and a light receiving part **85** receiving the light from the light emitting part **84**.

In a configuration as mentioned above, in a situation where the detected part **82** is not rotated, i.e., in a situation where the fixing belt **21**, cap member **81** and elastic member **34** are not rotated, an optical path from the light emitting part **84** to the light receiving part **85** in the sensor **83** is not opened/closed by the detected part **82**, and then, a received light amount is kept constant by High level or Low level. In such a case, it is possible to decide that the fixing belt **21** is not rotated.

On the other hand, in a situation where the detected part **82** is rotated, i.e., in a situation where the fixing belt **21**, cap member **81** and elastic member **34** are rotated, an optical path from the light emitting part **84** to the light receiving part **85** in the sensor **83** is sequentially opened/closed by the detected part **82**, and then, the received light amount is sequentially switched between the High level and Low level. In such a case, it is possible to decide that the fixing belt **21** is rotated.

By applying such a configuration, it is possible to decide on the basis of a detection result of the sensor **83** whether or not the fixing belt **21** is rotated. Therefore, it is possible to avoid a situation where the fixing belt **21** without rotation is heated.

Third Embodiment

Next, the third embodiment of the present disclosure will be described with reference to FIG. **9**. An arrow Fr in FIG. **9** indicates the front side of fixing device **18**. An arrow I in FIG. **9** indicates the inside in forward and backward directions and an arrow O in FIG. **9** indicates the outside in the forward and backward directions. Since other components except for an elastic member **90** are configured in a similar way to the first embodiment, same reference numerals as the first embodiment are attached to the other components (particularly, in the figures) and the description of the other components is omitted. With regard to similar parts of the elastic member **90** to the elastic member **34** in the first embodiment, same reference numerals as the elastic member **34** are attached (particularly, in the figures) and the description is omitted.

In the fifth wall part **75** of the elastic member **90**, a detected part **91** is arranged. The fifth wall part **75** of the elastic member **90** corresponds to the outer circumference part of the entire elastic member **90**. In the detected part **91**, a plurality of notched parts **92** and a plurality of non-notched parts **93** arranged at intervals of formation of the notched parts **92** are arranged alternately in a circumferential direction.

Above the fifth wall part **75** of the elastic member **90**, a sensor **94** (a detecting part) is arranged. The sensor **94** is, for example, a reflection light type optical sensor to have a function detecting a distance to a detected object.

In a configuration as mentioned above, in a situation where the detected part **91** is not rotated, i.e., in a situation where the fixing belt **21**, cap member **33** and elastic member **90** are not rotated, light from the sensor **94** continuously hits the non-notched part **93** of the detected part **91** or passes through the notched part **92** of the detected part **91** and continuously hits the flange part **62** of the cap member **33**. Therefore, the distance from the sensor **94** to the detected object is kept constant. In such a case, it is possible to decide that the fixing belt **21** is not rotated.

On the other hand, in a situation where the detected part **91** is rotated, i.e., in a situation where the fixing belt **21**, cap member **33** and elastic member **90** are rotated, the light from the sensor **94** hits the non-notched part **93** of the detected part **91** and the flange part **62** of the cap member **33** alternately. Therefore, the distance from the sensor **94** to the detected object is sequentially switched. In such a case, it is possible to decide that the fixing belt **21** is rotated.

By applying such a configuration, it is possible to decide on the basis of a detection result of the sensor **94** whether or not the fixing belt **21** is rotated. Therefore, it is possible to avoid a situation where the fixing belt **21** without rotation is heated.

While the present disclosure has been described with reference to the particular illustrative embodiments, it is not to be restricted by the embodiments. It is to be appreciated that those skilled in the art can change or modify the embodiments without departing from the scope and spirit of the present disclosure.

What is claimed is:

1. A fixing device comprising:

a fixing belt rotating around a rotation axis;

a pressuring rotation body coming into pressure contact with the fixing belt to form a fixing nip;

a cap member attached to an end part of the fixing belt, the cap member including

a main body part covering outside in the rotation axis direction of the end part of the fixing belt, and

a flange part extending from the main body part to inside in the rotation axis direction and covering an external diameter side of the end part of the fixing belt; and

an elastic member interposed between the end part of the fixing belt and the cap member, the elastic member including

a belt insertion part into which the end part of the fixing belt is inserted,

a cap insertion part into which the flange part is inserted, the cap insertion part arranged at the external diameter side from the belt insertion part and

a contact part arranged at the outside in the rotation axis direction from the belt insertion part and cap insertion part to come into contact with an internal side face in the rotation axis direction of the main body part;

wherein when the fixing belt is deformed to an internal diameter side, the elastic member is elastically deformed so as to make the belt insertion part moved to the internal diameter side with respect to the cap insertion part, and then, a gap is formed in at least a part between the internal side face in the rotation axis direction of the main body part and the contact part.

2. The fixing device according to claim **1**, wherein

the elastic member includes:

a first wall part extending in the rotation axis direction;

a second wall part bent from the first wall part to the internal diameter side;

a third wall part bent from the second wall part to the inside in the rotation axis direction;

a fourth wall part bent from the first wall part to the external diameter side; and

a fifth wall part bent from the fourth wall part to the outside in the rotation axis direction,

wherein the belt insertion part is formed so as to be surrounded by the first wall part, second wall part and third wall part,

the cap insertion part is formed so as to be surrounded by the first wall part, fourth wall part and fifth wall part,

the contact part is arranged on an outside face in the rotation axis direction of the second wall part.

3. The fixing device according to claim **1**, wherein

when the fixing belt is deformed to the internal diameter side, a gap is formed in at least a part between the belt insertion part and the end part of the fixing belt and a gap is formed in at least a part between the cap insertion part and the flange part.

4. The fixing device according to claim **1**, wherein

a rib is arranged in the internal side face in the rotation axis direction of the main body part.

5. The fixing device according to claim **4**, wherein

a plurality of the ribs are arranged radially around the rotation axis.

6. The fixing device according to claim **1** further comprising:

a detected part provided on an outer circumference part of the cap member; and

a detecting part detecting rotation of the detected part.

7. The fixing device according to claim **1** further comprising:

a detected part provided on an outer circumference part of the elastic member; and

a detecting part detecting rotation of the detected part.

8. The fixing device according to claim **1** further comprising:

a pressing member pressing the fixing belt to a side of the pressuring rotation body; and

a supporting member supporting the pressing member.

9. The fixing device according to claim **1** further comprising:

a bias stopping member coming into contact with an outside face in the rotation axis direction of the main body part.

10. An image forming apparatus comprising:

a fixing device,

wherein the fixing device includes:

a fixing belt rotating around a rotation axis;

a pressuring rotation body coming into pressure contact with the fixing belt to form a fixing nip;

a cap member attached to an end part of the fixing belt, the cap member including

a main body part covering outside in the rotation axis direction of the end part of the fixing belt, and

a flange part extending from the main body part to inside in the rotation axis direction and covering an external diameter side of the end part of the fixing belt; and

an elastic member interposed between the end part of the fixing belt and the cap member, the elastic member including

a belt insertion part into which the end part of the fixing belt is inserted,

a cap insertion part into which the flange part is inserted, the cap insertion part arranged at the external diameter side from the belt insertion part and

a contact part arranged at the outside in the rotation axis direction from the belt insertion part and cap insertion part to come into contact with an internal side face in the rotation axis direction of the main body part;

wherein when the fixing belt is deformed to an internal diameter side, the elastic member is elastically deformed so as to make the belt insertion part moved to the internal diameter side with respect to the cap insertion part, and then, a gap is formed in at least a part between the internal side face in the rotation axis direction of the main body part and the contact part.

11. The image forming apparatus according to claim **10**, wherein

the elastic member includes:

a first wall part extending in the rotation axis direction;

a second wall part bent from the first wall part to the internal diameter side;

a third wall part bent from the second wall part to the inside in the rotation axis direction;

a fourth wall part bent from the first wall part to the external diameter side; and

a fifth wall part bent from the fourth wall part to the outside in the rotation axis direction,

wherein the belt insertion part is formed so as to be surrounded by the first wall part, second wall part and third wall part,

the cap insertion part is formed so as to be surrounded by the first wall part, fourth wall part and fifth wall part,

the contact part is arranged on an outside face in the rotation axis direction of the second wall part.

12. The image forming apparatus according to claim **10**, wherein

when the fixing belt is deformed to the internal diameter side, a gap is formed in at least a part between the belt insertion part and the end part of the fixing belt and a gap is formed in at least a part between the cap insertion part and the flange part.

13. The image forming apparatus according to claim **10**, wherein

a rib is arranged in the internal side face in the rotation axis direction of the main body part.

14. The image forming apparatus according to claim **13**, wherein

a plurality of the ribs are arranged radially around the rotation axis.

15. The image forming apparatus according to claim **10**, wherein the fixing device further includes:

a detected part provided on an outer circumference part of the cap member; and

a detecting part detecting rotation of the detected part.

16. The image forming apparatus according to claim **10**, wherein the fixing device further includes:

a detected part provided on an outer circumference part of the elastic member; and

a detecting part detecting rotation of the detected part.

17. The image forming apparatus according to claim **10**, wherein the fixing device further includes:

a pressing member pressing the fixing belt to a side of the pressuring rotation body; and

a supporting member supporting the pressing member.

18. The image forming apparatus according to claim **10**, wherein the fixing device further includes:

a bias stopping member coming into contact with an outside face in the rotation axis direction of the main body part.

* * * * *